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Chemical Abstract No. 105:202483 & J. Chromatog. Science (1986), 24(10), 462-3

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(54) Abstract Title
Generating a calibrating gas

(57) A controlled concentration generator of diluted calibrating gas which operates on the flow dilution method includes a flexible bag reservoir containing the gas source to be diluted where the bag is housed in a container and gas flow from the bag is controlled by pressurisation of the container. The bag may be of PTFE and the container may be transparent to allow the user to view the bag.

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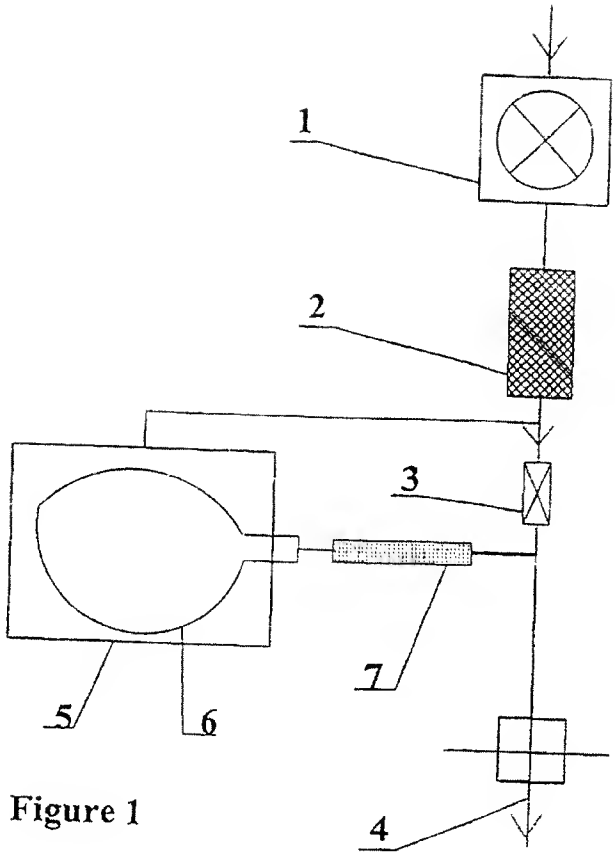

Figure 1

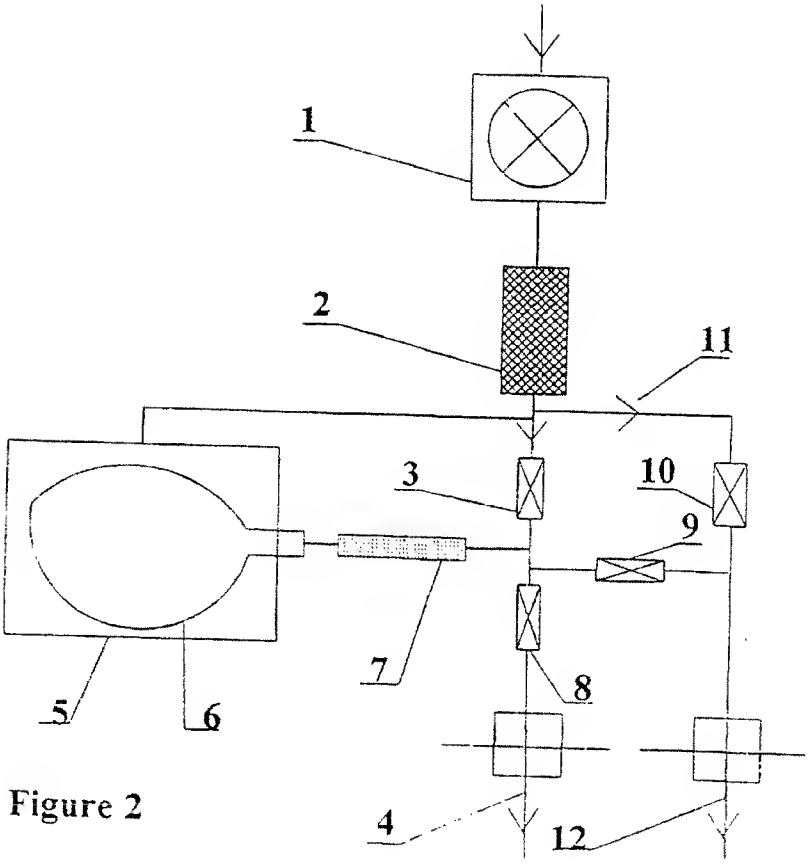

Figure 2

PORTABLE CALIBRATION GAS GENERATOR.

This invention relates to a method of producing controlled concentrations of a primary gas in air or other diluent gas. The primary gas may be toxic or reactive and difficult to store at low concentrations in cylinders. The primary gas may be a pure gas or a mixture of gases.

Controlled concentrations of gas in air or a diluent gas are required for calibration and testing of instruments used for the measurement of the gas concentration. In some cases the instruments are portable and the source of the controlled concentration of gas is also required to be portable. The usual method of providing this controlled concentration is a pressurised gas cylinder which contains the air or diluent gas plus a known concentration of the primary gas. There are limits within which this technique can be used. A limit exists at with very low concentrations. Very low concentrations may be affected by the reactive or absorptive property of the internal walls of the cylinder. Steel and aluminium, commonly used as materials from which cylinders are manufactured, both form oxide layers which can be reactive. In some cases special internal coatings are provided to reduce this effect which would otherwise cause the very low concentration of the gas to fall. If such a cylinder has been made up as a standard for calibration and certified then it has a finite life and beyond this period there is uncertainty as to how much the concentration has been affected by reaction with the wall of the cylinder. The problem of absorption or reaction is more severe with chemical elements or compounds which are reactive such chlorine, sulphur dioxide, ammonia, hydrogen sulphide or metallic hydrides but the problem is not limited to these materials.

An alternate method of providing the controlled calibration is the continuous flow dilution method. In this method a low flow of the primary gas is diluted with a higher flow of air or a diluent gas. The flow from the first dilution can be diluted a number of times with further flows of diluent to produce lower concentrations which are determined from knowledge of the diluent flows. In this method the flows of the primary gas are usually derived from cylinders of the pressurised primary gas and controlled by conventional flow controls such as needle valves and pressure regulators. The use of a cylinder and regulator may make it an unsuitable method for use as a portable device. An alternative of a small pressurised container fitted with a membrane to control the flow is often unacceptable because of the use of a pressurised container.

According to the present invention the continuous flow dilution method is used with a reservoir which is a flexible plastic bag in which is contained the primary gas. The reservoir is a bag of inert material such as polytetrafluoroethylene. Any inert plastic material may be used. There are several other plastic materials available some of which may be more suitable for an individual primary gas. The bag is housed in a container which is pressurised.

The container may be transparent to allow the user to view the size of the plastic bag and hence how much primary gas is still available. The pressure in the container may be applied by the back pressure resulting from the flow of diluent through a restriction or by a separate pressurisation system. As the bag is flexible, the pressure of the primary gas in the bag is the same as the pressure in the container in which it is housed. The primary gas pressure is applied to a flow restrictor which results in a low flow from it. The flow restrictor is a tube of suitable length of inert plastic packed with glass particles of a suitable a size to give the required low flow. This low flow is mixed with the diluent flow resulting in a flow of gas in which the primary gas is at a known lower concentration. The value of this concentration is known from a knowledge of the flows of the primary and diluent gas. The dilution may diluted again a second time or multiple dilutions carried out.

A specific embodiment of the invention will now be described by way of example with reference to the accompanying Figures. Referring to Figure 1. the pump 1 draws in atmospheric air which passes through a carbon trap 2 to remove any atmospheric impurities. The air flows through a restriction 3 and out to vent at 4. The back pressure due to the flow through the restrictor 3 is applied to a container 5 in which is contained the thin plastic bag 6 partly filled with the primary gas. This pressure causes a low flow of the primary gas through the restrictor 7 which mixes with higher air flow through restrictor 3. The resulting flow at 4 contains a concentration of the primary gas in air which is determined by measurement of the flows through the restrictors 7 and 3. Thus a flow through 3 of 999 ml per minute and a flow through 7 of 1 ml per minute would give an output concentration of the primary gas in air of 0.1%. The container 5 may be transparent to enable a user to view the size of the bag and determine how much more diluted gas may be obtained from the system before the bag 6 needs to be refilled with the primary gas.

A multiple dilution is shown in Figure 2. The system is the same as in Figure 1 with some additions. A restrictor 8 is added to the flow to the diluted outlet at 4 causing a back pressure which gives a flow through a restrictor 9. This flow from restrictor 9 mixes with a second diluent flow 12 derived from the pump by a "T" connection and restrictor 10.The double diluted outlet emerges at 12. If the flow though 10 is 990ml per minute and the flow through 9 is 10ml per minute the original first dilution has now been diluted a further 100 times giving an output concentration of primary gas in air of 0.001% or 10 parts per million.

CLAIMS

1. A controlled concentration generator of a diluted primary gas in which the primary gas is contained in a flexible plastic bag fitted in a container and the pressure in the bag is the same as the pressure in the container.

2. A controlled concentration generator as in Claim 1 where the flexible plastic bag is made of polytetrafluoroethylene or any fluoropolymer or plastic material which is inert to the primary gas contained within.

3. A controlled concentration generator as in Claim 1 or Claim 2 where the pressure in the plastic bag is controlled by the back pressure of the diluent flow through a restrictor or a separate flow and restriction.

4. A controlled concentration generator as in Claim 1 or Claim 2 or Claim 3 where the flow restriction of the primary gas emerging from the bag is of an inert plastic tube of suitable length packed with glass particles of suitable particle size as to form the required restriction to flow.

5. A controlled concentration generator as in Claim 1 or Claim 2 or Claim 3 or Claim 4 in which the flow from the restrictor of Claim 4 is diluted once or twice or more times to give the required concentration of primary gas in the final output.

6. A controlled concentration generator as in Claim 1 or Claim 2 or Claim 3 or Claim 4 or Claim 5 in which the primary gas is a pure gas or a mixture of gases and the diluent gas is air or any other gas.

7. A controlled concentration generator as in Claim 1 or Claim 2 or Claim 3 or Claim 4 or Claim 5 or Claim 6 in which the container housing the plastic bag is transparent to allow the user to determine how much primary gas is left in the plastic bag.

The Patent Office

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Claims searched: 1 - 7 **Date of search:** 7 November 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G1B (BAA, BBS, BCG, BCX)

Int Cl (Ed.6): G01N 1/38, 33/00

Other: Online: WPI, Claims, Japio, Analytical Abstracts, CAS

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	Chemical Abstract No. 105:202483 & J. Chromatog. Science (1986), 24(10), 462-3. See Abstract.	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.